CALCULATION TABLE FOR OBLIQUE ECCENTRIC COMPRESSION COLUMN BY INTERACTIVE CHART METHOD

Part 5 - Evaluate calculation results

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ABSTRACT

Interactive diagrams have been widely used in countries around the world and have been included in design standards such as ACI-318, BS-8110. In Vietnam, recent studies have also mentioned the construction of interactive charts to design reinforced concrete columns. The article researches to set up an automatic calculation table to calculate reinforcement for rectangular columns subjected to oblique eccentric compression. The author team also built a calculation table to check the bearing capacity of columns by the interactive chart method. many calculation examples were also conducted to verify the proposed calculation table and compare it with the calculation theory and the existing reinforcement calculation program. The author organizes the implementation according to the five main contents consist of: Part 1-Methodological content; Part 2-Principles of building interactive charts according to current Vietnamese standards; Part 3- Method of calculating reinforcement area; Part 4-Simulate the system on specialized software; Part 5- Evaluate calculation results.

Keyword: *Interactive chart, oblique eccentric compression, rebar calculation, bearing capacity, reinforced concrete column.*

1. INTRODUCTION

Reinforced concrete column structures subject to simultaneous effects of longitudinal forces and bending moments in both directions of the section is very common in multi-story building construction. In frame structural systems, columns supporting load-bearing beams are members subjected to both bending moment and compressive force, often they are called eccentric compression members. The column members in the frame will receive the load from the floors above, they transmit this load to the floors below and the building foundation through the foundation structure. If these compression-bearing members are not capable of bearing forces at adverse locations, they can cause damage to the entire structure. Damaged columnar structure in a building can cause more damage to people and property than horizontal load-bearing structures such as beams and bars. So the design is often calculated with a higher level of safety. Failures due to the compressive or brittle failure are more abrupt than plastic failure.

A column subjected to oblique eccentric compression is a column that is simultaneously subjected to an axial compression force N and a bending moment in the two directions Mx, My taken for the major axes of the section. Currently, there are several methods of calculating oblique eccentric columns such as: The additive method introduced by Moran, the reinforcement is calculated separately from (N, Mx)và (N, My), then add the results, detailed in [1]; Method to convert oblique eccentricity to internal flat eccentric [2], Bresler's test method is based on the idea of failure side [3], the method introduced by Row and Paulay [8] is to use directly the interaction diagram for rectangular cross-section subjected to oblique eccentric compression. Each graph contains four quadrants, each

of which corresponds to a load application angle. When the actual load angle does not coincide with the load angle in the chart, it must be interpolated.

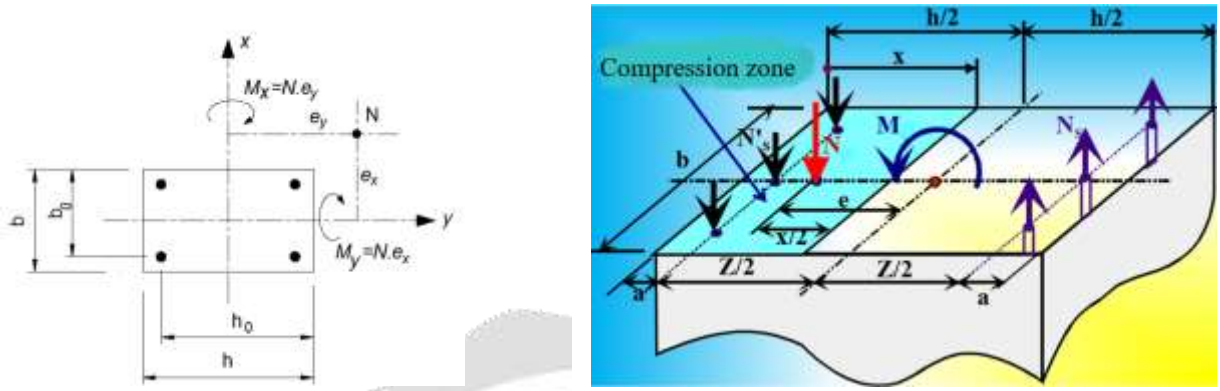

Figure 1. Cross-section of columns subjected to oblique eccentric compression

The internal force to calculate the column subjected to oblique eccentric compression is taken from the result of the load combination, in which it is necessary to pay attention to the following triples of internal forces (N, M_x, M_y):
+ N_{max} and M_x, M_y respectively
+ M_{ymax} and N, M_x respectively
+ M_x and M_y great value and N respectively.

2. EVALUATE THE RESULTS OF THE PROPOSED CALCULATION TABLE

The program is programmed to automatically design A_S reinforcement for columns subjected to oblique eccentric compression. It allows the user to check any cross-section, or adjust the size as desired.

There are a total of 11 numbers that need to be entered (in red). Other parameters are automatically calculated by the program. The user will adjust the number and diameter of reinforcement so that the safety factor kat =1÷1,2 is reasonable. The output of the program includes the number of reinforcement bars arranged in the section and interactive charts.

Calculation by 3 programs with the same input data. It is the proposed calculation table, the RDW program has been licensed and calculated using the theoretical formula. From the comparison table of reinforcement calculation results, we can see that the calculation according to the new calculation table proposed for the reinforcement value is larger and close to that calculated by the theoretical formula (see the column of percentage comparison between reinforcement calculated according to the proposed program and the theoretical formula). At the same time, the calculation of reinforcement using the proposed new calculation table is smaller than that in RDW (see the percentage column in the table comparing reinforcement calculated by RDW and calculated by theory).

Table 1. Comparison of reinforcement values when calculating by three programs

Numerical order	Proposed calculation table		RDW		The theoretical formula
	Ast	%	Ast	%	Ast
1	26.1	10.08	27.5	16.0	23.71
2	35.2	6.02	36	8.4	33.2
3	50.3	5.23	51.5	7.7	47.8
4	15.4	9.22	16	13.5	14.1
5	18.5	8.82	19	11.8	17
6	20.4	7.37	21.7	14.2	19
7	7.8	8.33	7	-2.8	7.2
8	52.3	6.52	52.1	6.1	49.1
9	16.4	9.33	17	13.3	15
10	66.2	2.95	68.1	5.9	64.3
11	10.3	0.98	9.8	-3.9	10.2
12	12.7	0.79	12	-4.8	12.6
13	44.5	5.70	44.7	6.2	42.1
14	40.8	11.78	41	12.3	36.5
15	35.8	6.23	36	6.8	33.7

3. CONCLUSIONS

The results of calculating reinforcement for columns subjected to oblique eccentric compression using the RDW program give results that are too safety-biased compared with those calculated by the theoretical formula in the standard. The article presented the construction of a program to test the bearing capacity of columns by the interactive chart method. At the same time, a program to calculate reinforcement for columns subjected to oblique eccentric compression was built. Calculation results have been verified through many examples, typically some of the examples above. During the implementation of the reinforcement calculation program, it is necessary to select the reinforcement options so that the safety factor reaching from 1.0 to 1.2 is the most reasonable. The program to draw the cross-sectional curve of the interactive chart according to N_z gives quick results and is very convenient for testing the oblique eccentric compression resistance of a given reinforcement layout section.

4. ACKNOWLEDGEMENT

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